

1. A 200g mass and a 250g mass are suspended over a pulley. Determine the acceleration of the masses and the tension in the connecting cord.



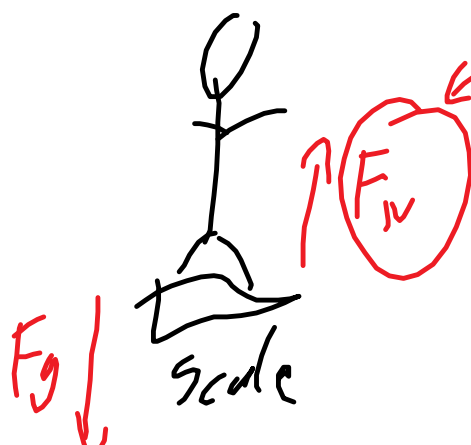
$$a = 2.0 \text{ m/s}^2$$

$$= F_N - F_g = ma$$

$$F_N = ma + F_g$$

$$F_N = 50(2) + 490$$

$$= \boxed{590 \text{ N}}$$



scale reads


$$F_N = F_g = mg$$

$$= 50 \text{ kg} \times 9.8 \text{ N/kg}$$

$$= \boxed{490 \text{ N}}$$

$$F_{\text{net}} = ma = \sum F$$

a?

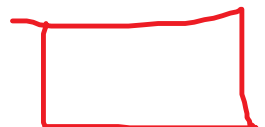


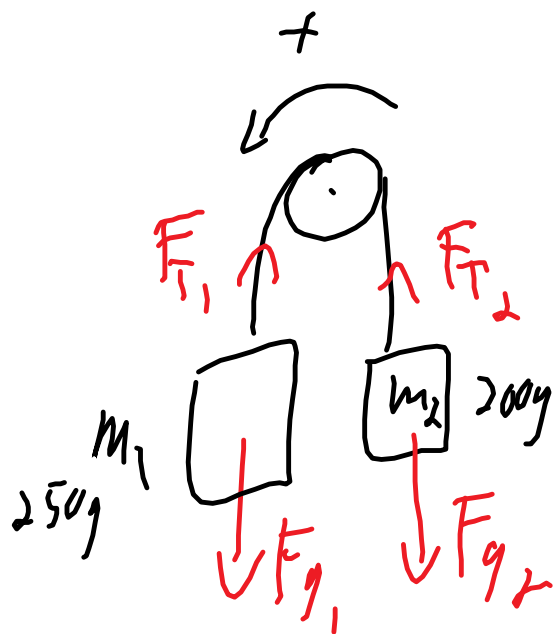
direction

$$ma = F_N - F_g$$

$$F_N = ma + F_g$$

$$F_N = 50(2) + 490 = \boxed{590 \text{ N}}$$





$$F_{T1} = F_{T2}$$

$$F_{\text{net}} = ma = \sum \vec{F}$$

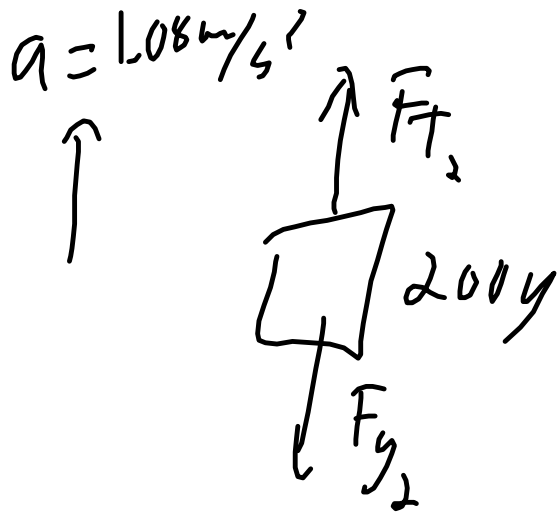
$\uparrow$  whole system       $\uparrow$   $F_{g1} - F_{g2} + \cancel{F_{T2}} - \cancel{F_{T1}}$

tension cancels

$$(m_1 + m_2) a = m_1 g - m_2 g$$

$$(0.25 \text{ kg} + 0.20 \text{ kg}) a = 0.25 \text{ kg}(9.8 \text{ m/s}^2) - 0.2(9.8)$$

$$a = 1.1 \text{ m/s}^2$$



$$F_{\text{net}} = \Sigma F$$

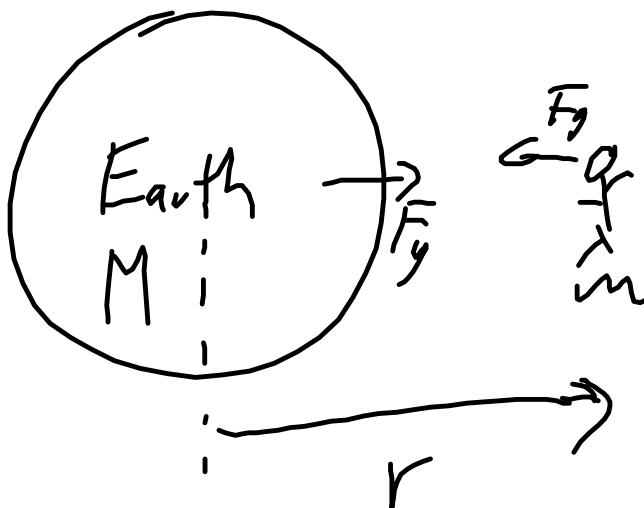
$$m_a a = F_{T_2} - F_{g_2}$$

$$F_{T_2} = m_a a + m_a g$$

$$F_{T_2} = 0.2(1.08) + 0.2(9.8)$$

$$= \boxed{2.2 \text{ N}}$$

## Universal Gravitation



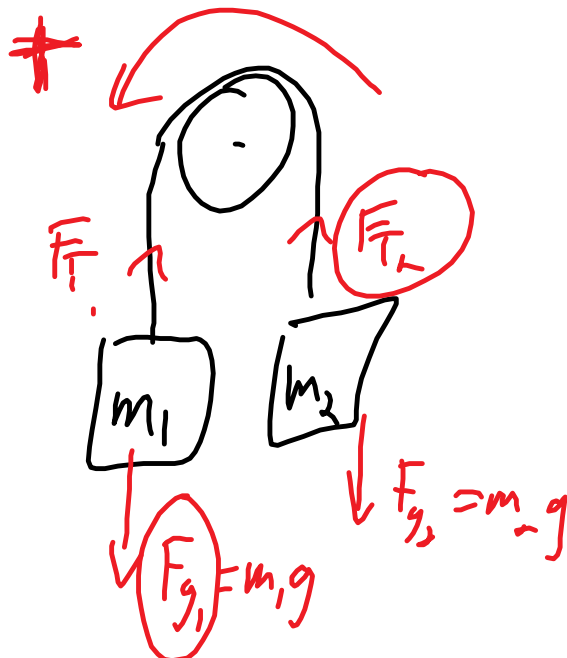
$$F_g = \frac{GMm}{r^2}$$

$F_g$  is the force pulling any two masses  $M$  and  $m$  a distance  $r$  apart.

$G$  is gravitational constant  
 $6.67 \times 10^{-11} \frac{N m^2}{kg^2}$

### Friction Lab - conclusion and sources of uncertainty

1. What is the force of gravity between a 50.0 kg and a 60.0 kg student 1.5 m apart?
2. If the Earth has  $g=9.80 \text{ m/s}^2$  and a radius of  $6.38 \times 10^6 \text{ m}$ , what is its mass?



$$F_{T1} = F_{T2}$$

Conclusion

$$F_{\text{net}} = ma = \sum F$$

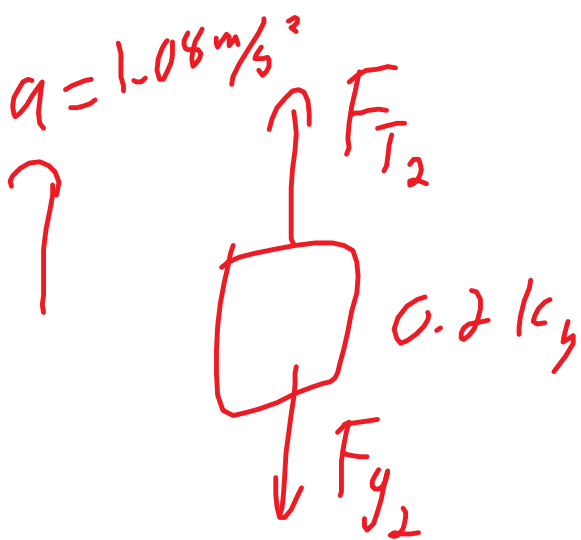
$\uparrow$  2 masses                       $\uparrow$   $F_{g1} - F_{g2} + \cancel{F_{T2} - F_{T1}}$

tension cancels

$$(m_1 + m_2)a = m_1g - m_2g$$

$$(0.25 \text{ kg} + 0.2 \text{ kg})a = 0.25 \times 9.8 - 0.2 \times 9.8$$

$$a = 1.1 \text{ m/s}^2$$



$$F_{\text{net}} = ma = \sum F$$

$$m_2 a = F_{T2} - F_{g2}$$

$$F_{T2} = m_2 a + F_{g2}$$

$$F_{T2} = \frac{0.2(1.1) + 0.2(9.8)}{1} = \boxed{2.2 \text{ N}}$$

$$172 = \boxed{2.2 \text{ N}}$$

## Universal Gravitation

### What is gravity?

### Newtonian Gravity

All objects create a force of gravity pulling each other together.

Gravitational pull is proportional to the masses, and inversely proportional to the distance between the centre of the masses.

$$F_g = GMm/r^2$$

$F_g$  is the force pulling the two masses together, in Newtons, N.

M and m are any two masses, in kg.

r is the distance between the centre of the masses, in metres, m.

G is universal gravitational constant

$$6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$$

Homework:

friction lab - include a conclusion and sources of uncertainty

1. What is the force of gravity between a 50.0kg student and a 60.0 kg student 1.5 m apart?  
Why do you not feel this force?
2. If  $g=9.80\text{m/s}^2$  and the radius of the Earth is  $6.38 \times 10^6 \text{ m}$ , determine the mass of the Earth.

## Chapter 8.1